

REMARKS

Claims 1-10 are pending in the present Application. Claims 2, 3, 8, and 9 have been canceled, Claims 1 and 5 have been amended, and no claims have been added, leaving Claims 1, 4-7, and 10 for consideration upon entry of the present Amendment.

Claims 1 and 5 have been amended to include limitations of Claims 2 and 3, and 8 and 9 respectively, canceled herewith, and to include additional limitations of cathode active material particles and an upper limit for the surface area of the metal hydroxide of $10 \text{ m}^2/\text{g}$. Support for these amendments can be found at least in the Specification, published as PCT/KR2004/001897, on p. 4, line 19 to p. 5, line 24. Further, Claim 5 has been amended to depend from Claim 1.

Reconsideration and allowance of the claims are respectfully requested in view of the above amendments and the following remarks.

Claim Rejections Under 35 U.S.C. § 102(b)

Claims 1, 2, 4, 5, 8 and 10 stand rejected under 35 U.S.C. § 102(b), as allegedly anticipated by U.S. Patent No. 6,998,071 ("Maeda"). Applicants respectfully traverse this rejection.

To anticipate a claim, a reference must disclose each and every element of the claim. *Lewmar Marine v. Varient Inc.*, 3 U.S.P.Q.2d 1766 (Fed. Cir. 1987).

Claims 1 and 5, as amended, includes the limitations of Claim 3 and 9 respectively, neither of which is rejected as anticipated by Maeda. Therefore, Claims 1 and 5, as amended, do not disclose all limitations of Claims 1, 5, and dependents, and cannot therefore anticipate these claims.

Reconsideration and withdrawal of the anticipatory rejection of Claims 1, 2, 4, 5, 8, and 10 is therefore respectfully requested.

Claim Rejections Under 35 U.S.C. § 103(a)

Claim 3 stands rejected under 35 U.S.C. § 103(a), as allegedly unpatentable over Maeda as applied to Claims 1, 2, 4, 5, 8, and 10, and further in view of U.S. Patent No. 4,913,988 ("Langan").

Claim 6 stands rejected under 35 U.S.C. § 103(a), as allegedly unpatentable over

Maeda as applied to Claims 1, 2, 4, 5, 8, and 10, and further in view of Japanese Patent Publication No. 2002-8718 (“Hibara”).

Claim 7 also stands rejected under 35 U.S.C. § 103(a), as allegedly unpatentable over Maeda in view of Hibara as applied to Claims 1, 2, 4-6, 8, and 10, and further in view of Japanese Patent Publication No. 2002-83632 (“Unoki”).

Applicants note that Claim 1 has been amended to include the limitations of Claim 3, which has been canceled; and that Claim 5 has been amended to depend from Claim 1. Hence, the rejection of Claim 3 will be addressed as a rejection of Claim 1 and its dependents. Applicants therefore respectfully traverse these rejections.

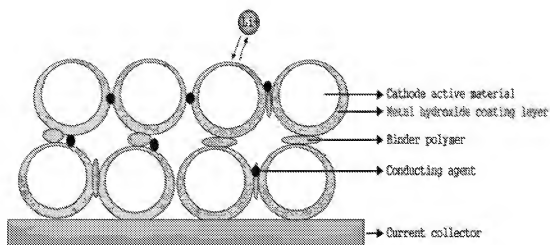
Claim 1, amended to include the limitations of Claim 3, claims a cathode for a lithium ion battery comprising (a) cathode active material particles and (b) metal hydroxide having a specific surface area of between $2.5 \text{ m}^2/\text{g}$ and $10 \text{ m}^2/\text{g}$, as a cathode additive, in which the metal hydroxide is included in an amount greater than 0 wt% and less than 10 wt%.

Generally, lithium ion batteries are used at a high drive voltage (0 to 5V). Therefore, when a lithium ion battery is exposed to high temperatures (i.e., 40°C) for extended periods after complete charge, the capacity of such a battery may decrease and the impedance of a battery may rapidly increase.

The metal hydroxide included in a cathode component, as claimed in Claim 1, acts to improve storage properties of the battery at a high temperature. However, the metal hydroxide is a “nonconductor” by nature. A metal hydroxide, if added to a cathode in an excessive amount, may therefore *decrease* battery capacity and degrade storage properties of a battery at a high temperature.

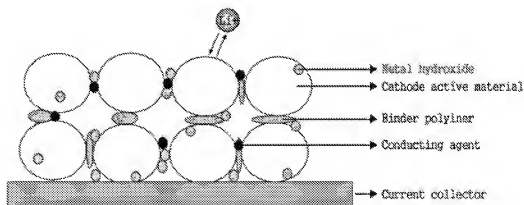
Further, if a cathode active material were *coated* with the metal hydroxide, the cathode active material particles would be unable to make direct contact with one another through the metal hydroxide coating layer formed on the surface of the cathode active material particles, and cannot therefore be interconnected “physically” and/or “electrically” from the lack of direct contact of the cathode active material particles due to the intervening the metal hydroxide. Please refer to FIG. 1 below (i.e., “metal hydroxide coating layer”), which illustrates this:

FIG. 1



The cathode of Claim 1 is thus characterized by use of the metal hydroxide as a cathode *additive* in a minimal amount and having a specific surface area adjusted to be within a certain range (for example, 2.5 to 100 m²/g), and not as a coating. Please refer to FIG. 2 below to illustrate this feature.

FIG. 2



By using a metal hydroxide having a large specific surface area as the cathode additive, it is possible to obtain *both* the excellent storage properties of a battery at a high temperature so as to minimize any decrease in battery capacity, *and* to prevent increase of battery impedance that would result from completely coating the particles with metal

hydroxide. These desirable features can be obtained even if the metal hydroxide having a high surface area as claimed is added in a relatively small amount (greater than 0 wt% to less than 10% as claimed in Claim 1). Further, any decrease in the battery capacity that would arise from the inclusion of higher amounts of metal hydroxide to the cathode may be minimized.

The effect of the improvement in storage properties of the battery at a high temperature (i.e., minimizing the decrease in (or loss of) battery capacity, thereby preventing increase of the battery impedance) as described above is supported by the description in the Specification on pages 12 to 16, (Storage characteristic test at high temperature) and Tables 1-3 in the Specification.

As to the combination of Maeda and Langan, Maeda and Langan disclose, respectively, magnesium hydroxide and calcium hydroxide as a component of the cathode. However, neither reference discloses adjusting the specific surface area of the metal hydroxide to a certain range [e.g., 2.5-100 m²/g] as claimed in Claim 1. For this reason at least, Maeda Further, Maeda and Langan do not teach or suggest that the specific surface area of the metal hydroxide added to the cathode of the battery is related with storage properties of the battery at a high temperature, and thus neither of these references provides a suggestion or incentive that would lead one skilled in the art to include a metal hydroxide having a specific surface area as claimed in Claim 1. For an obviousness rejection to be proper, the Examiner must meet the burden of establishing that all elements of the invention are disclosed in the prior art; that the prior art relied upon, or knowledge generally available in the art at the time of the invention, must provide some suggestion or incentive that would have motivated the skilled artisan to modify a reference or combined references. *In re Fine*, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988). “A patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art.” *KSR Int’l Co. v. Teleflex Inc.*, 127 S.Ct. 1727, 1741 (2007). To find obviousness, the Examiner must “identify a reason that would have prompted a person of ordinary skill in the art in the relevant field to combine the elements in the way the claimed new invention does.” *Id.*

Maeda discloses the BET specific surface area value (e.g., 0.5-50 m²/g) for “cobalt oxide particles” coated with magnesium hydroxide, but not for magnesium hydroxide added as a discrete component, as claimed in the instant claims.

Additionally, the cobalt oxide particles coated with magnesium hydroxide of Maeda are not actually cathode active material, but are *precursor compounds* [(1-x)Co₂O₃·3xMg(OH)₂] for forming the cathode active material. Maeda, Col. 6, lines 16-44. Claim 1 does not claim a specific surface area for the cathode active material particles, but only for the metal hydroxide. One skilled in the art will appreciate that these are not identical.

Maeda discloses *coating* individual cobalt oxide particles with magnesium hydroxide as illustrated in FIG. 1, whereas the metal hydroxide claimed in Claim 1 is included as a cathode additive (i.e. cathode slurry additive) [see FIG. 2]. Where a cathode is formed by using cobalt oxide particles coated with the magnesium hydroxide in Maeda, the cathode active material particles cannot make contact directly with one another due to the intervention of the metal hydroxide coating layer formed on the surface of the cathode active material particles, and thus, as discussed above, cannot be interconnected “physically” and/or “electrically” due to **non-conductivity** of the metal hydroxide.

Thus, the surface of cathode active material in Maeda is surrounded with the metal hydroxide coating layer. Since the metal hydroxide is nonconductor and is not capable of lithium ion intercalation/deintercalation, the metal hydroxide coating layer serves as a resistive layer which interrupts lithium ion movement from the cathode active material during charge/discharge cycles, thereby undesirably *increasing* the battery impedance.

Because Maeda forms a cathode by use of the cobalt oxide particles coated with magnesium hydroxide, it is distinguishable from the claimed invention in terms of constitution. Further, the cathode active material particles coated by the metal hydroxide in Maeda cannot be electrically interconnected, thereby causing degradation in battery performance such as good rate property and high output.

Moreover, it is not easy to adjust the specific surface area of the metal hydroxide within a certain range such as 2.5-100 m²/g, even if magnesium hydroxide coating layer is formed on the surface of the cathode active material in Maeda.

With regard to the second reference in the combination, Langan, in addition to disclosing calcium hydroxide, includes lithium carbonate (Li₂CO₃) as the “*essential component*” constituting the cathode. Claim 1 does not claim lithium carbonate.

To thus remove lithium carbonate from any combination of Maeda and Langan would alter the principle of operation of Langan. In this regard, the courts have held that “[i]f the

proposed modification would render the prior art invention being modified unsatisfactorily for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon* 733 F. 2d 900, 221 USPQ 1125 (Fed. Cir. 1984). The courts have also held that "[i]f the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims prima facie obvious." *In re Ratti* 270 F. 2d 810, 123 USPQ 349 (CCPA 1959). There is therefore no suggestion or incentive in Langan to remove an essential element from the combination of Maeda and Langan to recite the elements of Claim 1, and therefore, Maeda in view of Langan does not render Claim 1 unpatentable.

Regarding the rejections of Claims 6 and 7 over Maeda in view of Hibara, and Maeda in view of Hibara and further in view of Unoki, Claim 1 includes the limitations of Claim 3, where no combination of Maeda, Hibara, or Unoki is used to reject Claim 3; and therefore the combinations of Maeda, Hibara, and Unoki do not disclose all limitations of the instant claims and do not render these claims unpatentable.

It is believed that the foregoing amendments and remarks fully comply with the Office Action and that the claims herein should now be allowable to Applicants. Accordingly, reconsideration and allowance are requested.

If there are any additional charges with respect to this Amendment or otherwise, please charge them to Deposit Account No. 06-1130.

Respectfully submitted,

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